



User's Guide

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FLR 1000 & 1000-BR Series Flow Sensors & Meters For Gases



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WARNING: These products are not designed for use in, and should not be used for, human applications.



READ THIS MANUAL COMPLETELY BEFORE ATTEMPTING TO CONNECT OR OPERATE YOUR FLOW SENSOR. FAILURE TO DO SO MAY RESULT IN INJURY TO YOU OR DAMAGE TO THE FLOW SENSOR.

TABLE OF CONTENTS

A.	Introduction.....	4
	1. Unpacking	4
	2. Product Overview And Principle Of Operation	4
B.	Installation	5
	1. General Considerations.....	6
	2. Mounting the Flow Sensor or Flow Meter	6
	3. Tubing Connections	7
	4. Electrical Connections	8
	a) Overview	8
	b) Connecting a Cable Assembly.....	9
	c) Electrical Connections - Voltage Output Units	10
	d) Using a 0-5VDC Output Power Adapter Package.....	11
C.	Operation	12
	1. Start-Up	12
	2. Flow Readings	12
	a) 0-5VDC Analog Outputs	12
	b) Units with an Integral Display	12
	3. Operating at Flow Rates Outside the Calibrated Flow Range	13
	a) Flows Above the Maximum Rated Flow.....	13
	b) Flows Below the Maximum Rated Flow	13
	4. Zero Adjustments	14
	5. Recalibration	14
	6. Using Flow Sensors or Flow Meters with Different Gases.....	14
D.	Maintenance And Product Care.....	16
	1. General	16
	2. Cleaning and Flushing.....	16
	3. Returning Units For Repair Or Recalibration	16
E.	Specifications	17
F.	Connector Pin and Wire Color Cross Reference	18
G.	Dimensions	19
H.	Trouble Shooting Guide.....	26

A. Introduction

1. Unpacking

All units are suitably packaged to prevent damage during shipping. If external damage is noted upon receipt of the package, please contact **Omega Engineering** immediately.

Open the package from the top, taking care not to cut too deeply into the package. Remove all the documentation and contents. Take care to remove all the items and check them against the packing slip. The products should also be checked for any concealed shipping damage. If any shortages or damage is noted, please contact the shipping company and/or Omega Engineering to resolve the problem.

*Typical Contents of Box:
Sensor, Calibration Certificate & Instruction Manual
(Model FLR 1000 shown, other models similar).*

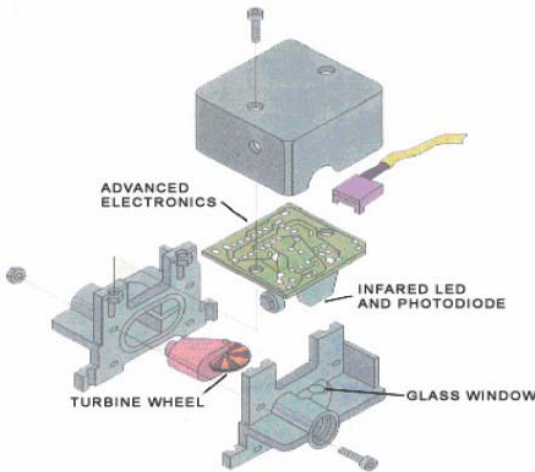


Caution: Take care not to **drop** your sensor or subject it to sudden impact. Read the installation section of this manual before providing power or tubing connections to the unit. Any damage caused by improper installation or careless handling will not be repaired under warranty (see limited warranty on page 28 for more details).

2. Product Overview and Principle of Operation

The FLR 1000 series of flow meters and sensors for gases from Omega Engineering are capable of measuring volumetric flows as low as 20-100 ml/min or as high as 100-500 l/min. Highly repeatable results are achieved using a patented Pelton Turbine Wheel flow sensor design. This

proven design minimizes zero drift while maintaining fast response and linear outputs with virtually no maintenance.



Flow is measured using a miniature turbine wheel similar in size to a U.S. dime (16 mm diameter, 0.75 mm thick). The micro-turbine wheel is supported on a very small sapphire shaft that is held in position by two sapphire bearings.

As flow passes through the sensor, a precision machined nozzle directs the gas onto the very small teeth of the micro-turbine wheel. This causes the wheel to spin at a speed proportional to the volumetric flow rate.

The micro-turbine wheel has alternating white and black sections evenly spaced on one side of the wheel. An infrared light beam is directed onto the wheel. As the wheel rotates the infrared beam is reflected off each white section. The reflected beam is detected by a phototransistor that converts the reflections into electrical pulses. As the wheel spins faster the pulse rate increases. Processing circuitry provides analog and/or pulse output that are linearly proportional to the volumetric flow rate

When the wheel stops (under zero flow conditions), no pulses are generated. Consequently, zero drift is not possible and zero adjustments are never required.

Every unit is supplied with a calibration certificate detailing the results obtained during calibration. Units are calibrated using AIR as the reference media. Flowing gases with different physical characteristics may effect the calibration.

B. Installation



Caution: Do not exceed the pressure, temperature or power operating ranges detailed in the SPECIFICATIONS section of this manual. Omega Engineering shall not be liable for any damage or injury caused by incorrect operation of their products.

1. General Considerations

It is recommended that a safety shut-off valve be installed upstream of (before) the sensor.

All wetted parts should be checked for compatibility with the gas to be used. If there are any incompatibilities eg. highly corrosive gas, then the unit may be damaged or fail prematurely. Such damage will not be repaired under warranty.

Units should be installed in a clean, dry environment with an ambient temperature that is as stable as possible. Avoid areas with strong magnetic fields, strong air flows or excessive vibration.

If the gas to be used may contain particles larger than 25 microns then a filter (25 microns or less) should be installed upstream of (before) the unit.

2. Mounting the Flow Sensor or Flow Meter.

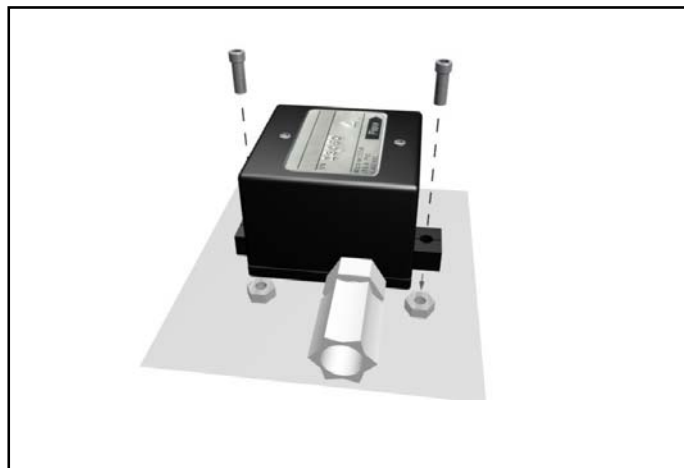


Caution: On high flow units (2.0-10.0 L/min, and above) DO NOT disassemble the shunt / mounting plate assembly or the unit will not operate correctly and the warranty will be void.

The Omega Engineering FLR 1000 Series units have no particular installation requirements so may be mounted in any convenient position. For optimum results the unit should be mounted with the mounting feet horizontal on top of a flat horizontal surface. This is the same position that the unit is calibrated in at the factory. Please contact the Omega Engineering Service Department if calibration for mounting in another orientation is desired.

It is recommended that units be fixed to a suitable substrate with #4 screws using the two mounting holes provided.

***Mounting The Sensor
(mounting hardware not included with sensor)***



3. Tubing Connections



CAUTION: DO NOT FLOW ANY LIQUID THROUGH A GAS FLOW SENSOR OR FLOW METER. THIS WILL SERIOUSLY EFFECT THE PERFORMANCE AND VOID THE WARRANTY.



CAUTION: DO NOT FLOW A HIGH PRESSURE GAS THROUGH THE SENSOR. A BURST OF HIGH PRESSURE GAS MAY CAUSE THE UNIT TO BE DAMAGED. ALWAYS FLOW GAS AT A PRESSURE AND FLOW RATE WITHIN THE SPECIFICATIONS OF THE UNIT

All tubing must be clean, dry and without crimps, burrs or scratches.

Only use the factory installed fittings on the unit. If the fittings are removed the calibration of the unit may be effected and leaking may occur. If different fittings are required please contact the Omega Engineering Company Service Department for assistance.

When connecting the sensor to the tubing a wrench should be used to stop the fitting rotating in the sensor body. Take care not to over tighten the fittings or leaking may occur.

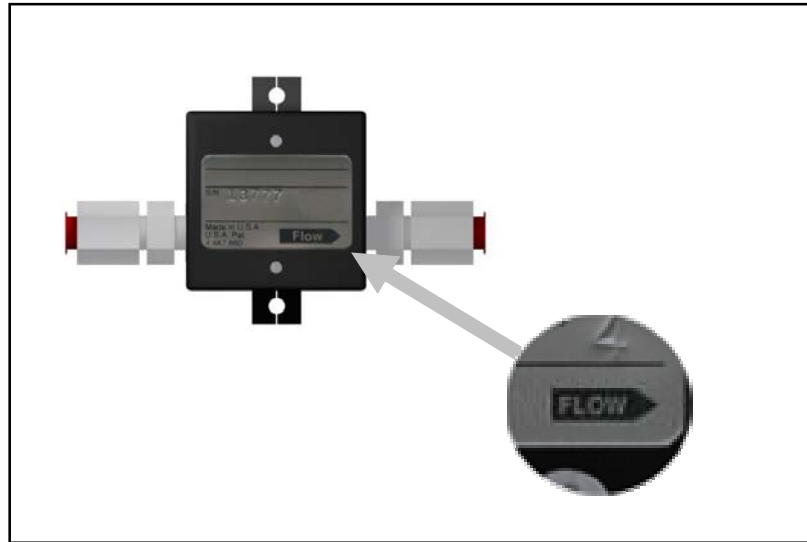
*Connecting and tightening the Fittings
(FLR 1000-ST-D shown, other models similar)*



Caution: DO NOT over tighten the fittings into the flow sensor or flow meter body. Excessive force may damage the sensor body. This type of damage will NOT be repaired under warranty.

The flow direction for the unit is clearly marked on the label. Do not reverse the flow direction or the unit will not function correctly.

**Close Up of Label Showing Flow Direction
(FLR 1000 shown, other models similar)**



The tubing ID should be as large as possible to avoid restrictions and turbulence. For the best results, a straight length of tubing before the unit is recommended. This should be 20 times the tubing I.D. or greater

4. Electrical Connections



Caution: Incorrect wiring may cause severe damage to the unit. Applying an AC voltage (115VAC or 230VAC) directly to the unit will cause damage. Read the following instructions carefully before making any connections.

a) Overview

Omega Engineering flow sensors for gases provide a 0-5VDC output proportional to the volumetric flow rate. This output may be connected to a display, data acquisition system or voltmeter. The FLR 1000-D and 1000-BR-D series feature an integral display that provides a local flow reading. These units also have a 0-5VDC analog output available. If required, this may be connected to another display, data acquisition system or voltmeter.

A stable D.C. power supply is required to operate the unit. The voltage and current requirements depend on the configuration of the unit. Full details may be found in the Specification section of this manual.

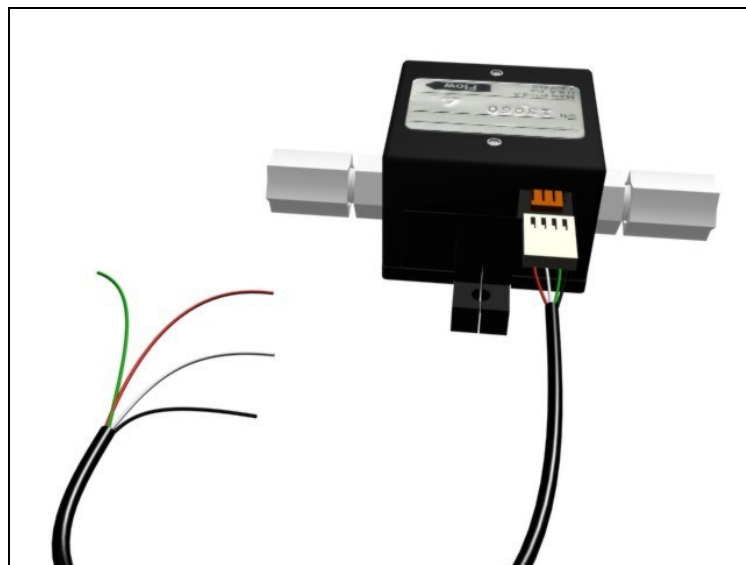
Connecting wires should be as short as possible to avoid voltage drops. Twisted 2 pair conductor cable of a suitable gauge should be used if the length of the power wires is to be longer than 1 meter (3.2 feet).

Units are supplied with an integral 4 pin connector. Connections to the unit are made using a mating cable assembly or power adapter package as detailed in the following sections. A connector pin and wire color cross reference may also be found in Appendix F (Page 18) of this manual.

b) Connecting a Cable Assembly

The connector on the end of the cable assembly should be pushed into the mating socket on the sensor taking care to ensure that it is the correct way up.

*Connecting the Cable Assembly
(FLR 1000 shown, other models similar)*

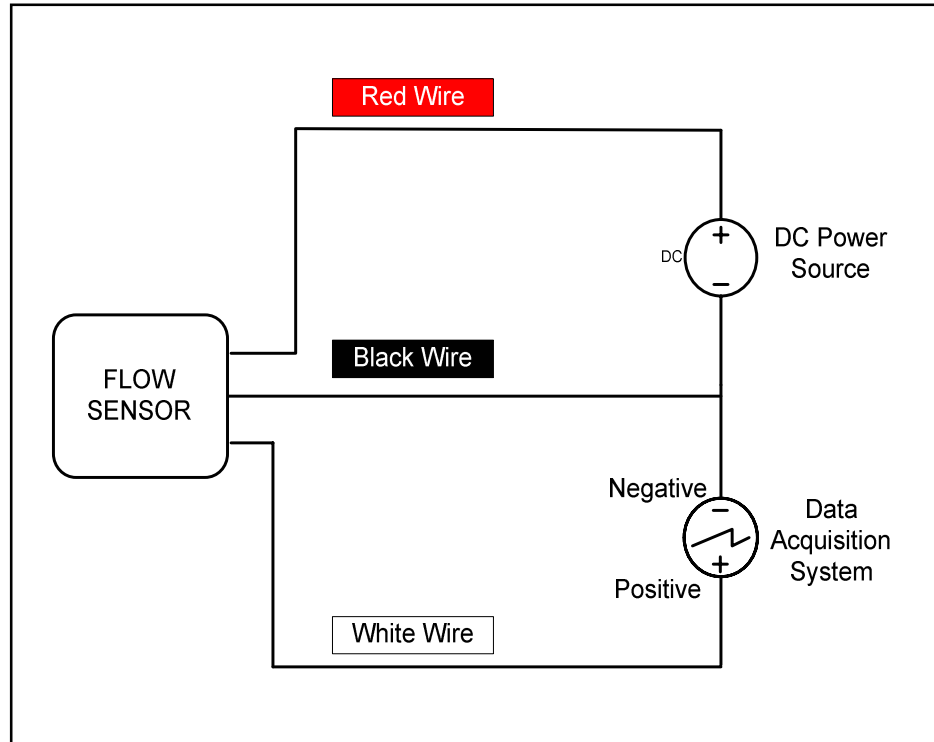


Electrical connections to the cable assembly are made as detailed in the following sections.

c) Electrical Connections – Voltage Output Units

The cable assembly should be connected to the sensor as detailed in section 5(b) above. Do not apply power to the sensor until all the connections have been made and checked. Electrical connections should be made as follows:

Wiring Schematic For Voltage Output Units.



The **RED** wire should be connected to the Positive of the power source.

The **BLACK** wire should be connected to the Negative (Ground) of the power source.

The **WHITE** wire provides the signal output and should be connected to the positive terminal of the display, data acquisition system or voltmeter with an impedance greater than 2500 Ω (Ohms).

The **GREEN** wire is not used.

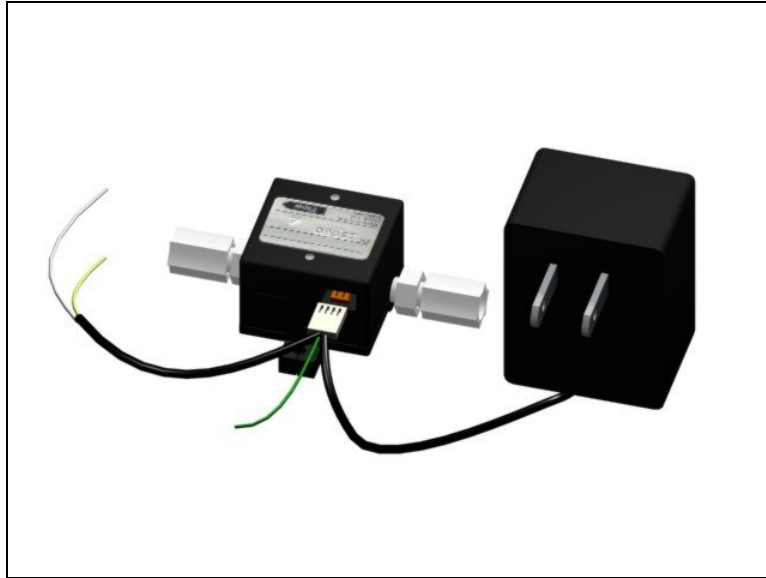


Caution: Avoid high voltage static discharges to any of the connections. Do not short the input/output signal wires or allow them to contact the power wires at any time. **DAMAGE WILL RESULT!**

d) Using a 0-5VDC Output Power Adapter Package.

An optional 0-5VDC Output Power Adapter Package is available for use with the FLR 1000 series (not the FLR 1000-ST-I). This consists of a power source (115VAC or 230VAC) and cable assembly with pig-tail (soldered wire) ends for the signal output. This should be assembled as shown in the following diagram.

*Connecting the Power Adapter to the Flow Sensor
(FLR 1000 shown, other models similar)*



The 0-5VDC analog output may be connected to a display, data acquisition system or voltmeter with a minimum load of 2.5 k Ω (kilo ohms).

The **YELLOW** wire of the cable assembly provides the 0-5VDC signal output and should be connected to the positive terminal of the display, data acquisition system or voltmeter.

The **GREEN** wire is not used.

The **WHITE** wire of the cable assembly is the signal negative and should be connected to the negative (ground) terminal of the voltmeter, display or data acquisition system.



Caution: Avoid high voltage static discharges to any of the connections. Do not short the output signal wires or allow them to contact the power wires at any time. **DAMAGE WILL RESULT!**

C. *Operation*



CAUTION: DO NOT FLOW ANY LIQUID THROUGH A GAS FLOW SENSOR OR FLOW METER. THIS WILL SERIOUSLY EFFECT THE PERFORMANCE AND VOID THE WARRANTY.

1. **Start Up**

Before applying power to the unit check all tubing and electrical connections. Once correct installation is verified switch on the power.

2. **Flow Readings**

The FLR 1000 Series for gases provide a 0-5VDC output proportional to the volumetric flow rate.

The FLR 1000-D and FLR 1000-BR-D series feature an integral 3.5 digit display that provides a local flow reading and a 0-5VDC analog output proportional to the volumetric flow rate.

Each unit is factory calibrated for a specific flow range. The flow range is shown on the unit's label and calibration certificate. Units are calibrated using AIR as the reference media unless otherwise noted. Calibrations are carried out with the mounting feet horizontal on a flat horizontal surface.

a) **0-5VDC Analog Outputs**

By monitoring the voltage output signal it is possible to determine the flow rate of the gas. Units are configured so that an output signal of 5.0VDC is provided when the maximum flow (i.e. Full Scale flow) is passing through the unit. The output signal is linear and scaleable enabling calculation of flow rates within the sensor's range.

For example:

For a flow range of 100-500ml/min:

At 500ml/min the output signal would be 5VDC

If the output signal were 3.5VDC then the flow rate would be:

$$(500 \div 5) \times 3.5 = 350\text{ml/min}$$

If the maximum flow rate is exceeded non-linear and inaccurate readings will result.

b) **Units With an Integral Display**

The FLR 1000-D and FLR 1000-BR-D series features an integral 3 ½ digit LCD display. This is configured to read in ml/min for flow ranges up to

100-500 ml/min and in l/min for flow ranges of 0.2 – 1.0 L/min and above. The display will only operate if power is applied to the unit.

Flow readings may be taken directly from the display or by monitoring the 0-5VDC analog output provided by using a cable assembly or power adapter package (see above).

*LCD Flow Display
(Model FLR1000-ST-D shown, other models with displays similar)*



3. Operating at Flow Rates Outside the Calibrated Flow Range



CAUTION: If the flow through the unit exceeds 120% of the maximum rated (full scale) flow the unit may be damaged. This type of damage will not be repaired under warranty.

Flow measurement is only accurate within the calibrated flow range for the unit. This is detailed on the calibration certificate. The unit will still operate, to some degree, outside this flow range.

Results obtained when operating outside the specified range of the unit are not accurate but may be considered repeatable.

a) Flows Above the Maximum Rated Flow.

If the flow rate is above the maximum rated (or full scale) flow, the unit will still operate and provide an output signal proportional to the flow rate.

Flows must not exceed 120% of the maximum rated flow or the unit may be damaged.

b) Flows Below the Minimum Rated Flow.

Signal outputs may be obtained at flow rates below the minimum specified for your unit. The amount of flow that may be measured below the minimum specified varies from unit to unit.

4. Zero Adjustments

It is impossible for there to be any zero drift so zero adjustments are never required.

5. Recalibration

Please contact the Omega Engineering Service Department if your flow sensor or flow meter needs recalibration.

6. Using Flow Sensors or Flow Meters with Different Gases

The FLR 1000 Series will operate with most gases subject to compatibility of the wetted parts. *For information about calibrating for Hydrogen or Helium, contact the Omega Engineering Service Department.*

Units are calibrated with AIR at a pressure of 760mmHg and temperature of 23°C unless otherwise detailed on the calibration certificate. Using other gases will effect the calibration. The amount of calibration error will depend on the characteristics of the gas being flowed.

The flow reading correction factor (or calibration factor) may be approximately calculated with the following formula:

$$C_f = (S_{\text{new}} \div S_{\text{current}})^{0.3}$$

C_f = Correction factor

S_{new} = Specific gravity of new gas

S_{current} = Specific gravity of original calibration gas

A corrected flow reading may then be calculated using the correction factor as follows:

$$\text{Corrected Flow} = \text{Flow reading} \times \text{Correction Factor}$$

For example, if the unit is calibrated for AIR but the user wants to measure the flow of Carbon Dioxide (CO₂) with a specific gravity of 1.517 the flow reading correction factor would be calculated as follows:

S_{new} = Specific gravity of CO₂ = 1.517

S_{current} = Specific gravity of Air = 1.000

$$C_f = (S_{\text{current}} \div S_{\text{new}})^{0.3}$$

$$C_f = (1.000 \div 1.517)^{0.3}$$

$$C_f = 0.88$$

If the unit has a flow reading of 200ml/min then the corrected flow reading (for CO₂) would be:

$$\text{Corrected Flow} = 200 \times 0.88 = 176 \text{ ml/min}$$



CAUTION: The use of correction factors can be subject to inaccuracy and errors of up to $\pm 10\%$. Please contact the Omega Engineering Service Department if accurate, certified recalibration is required.

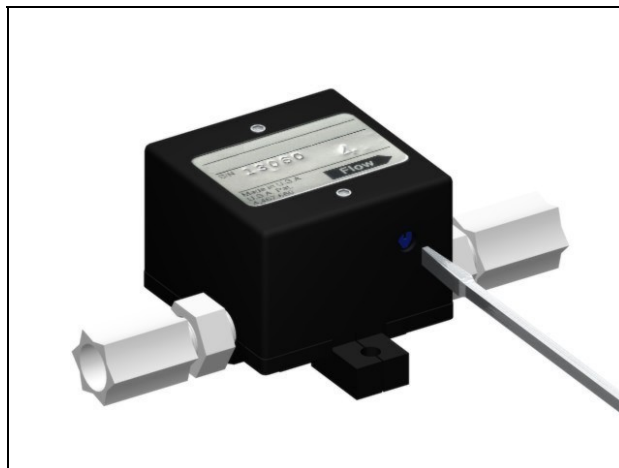
Calculating a correction factor for a gas enables the calibration of the unit to be adjusted for that gas. This is accomplished by:

- i) Calculate the corrected flow reading or VDC output at 100% of flow using the above formulas.
- ii) Adjust the flow of (the new) gas to give this flow reading
- iii) Maintain this flow and ensure a stable reading.
- iv) Adjust the gain potentiometer on the unit so that a 5VDC output is obtained. The unit is now calibrated for the new gas.

For example: A 2.0 -10.0 l/min unit that has been calibrated for Air is to be used with CO₂. The correction factor, calculated as above, is 0.88. When flowing CO₂ the unit will read high i.e. at 5VDC the flow of CO₂ would actually be 8.8 l/min and not 10 l/min. A flow of 10 l/min of CO₂ through the unit would give a reading of $10/0.88 = 11.36$ l/min or 5.68 VDC on the unit. Flow should be adjusted so that an output of 5.68VDC or reading of 11.36l/min is obtained. The gain potentiometer is then adjusted so that the voltage output becomes 5VDC or the display reads 10l/min. The unit has now been adjusted for CO₂ and no further corrections to flow readings are required (if flowing CO₂).

It should be noted that the maximum output voltage for the units is approximately 5.9VDC. It is not possible to adjust units if an output of greater than 5.9 VDC is required.

***Adjusting the Gain Potentiometer Using a Flat Head Screwdriver
(FLR 1000 shown, other models similar)***



D. Maintenance and Product Care

1. General



CAUTION: Do not disassemble your unit for any reason. If the unit appears to be malfunctioning please contact the Omega Engineering Service Department.

The FLR 1000 Series of flow meters and sensors require no periodic maintenance if used within the recommended specifications.

The next recommended recalibration date is stated on the calibration certificate supplied with the unit. Please contact the Omega Engineering Service Department for further information.

Inlet filters should be periodically checked and cleaned / replaced as necessary.

Regularly check all electrical and process connections for damage or deterioration.

If the sensor is to be stored, keep both the inlet and outlet ports sealed.

2. Cleaning and Flushing

If there is a build up of deposits or particles from the measured gases it may be necessary to clean *or flush* the unit. This should be done by flowing clean, particle free air (or Nitrogen) through the unit at a flow rate, pressure and temperature within the specifications of the unit. If necessary, flow may be reversed to assist flushing.



CAUTION: Do not flow a high pressure gas through the sensor. A burst of high pressure gas may cause the turbine wheel sensor to be damaged. Always flow gas at a pressure and flow rate within the specifications of the unit

3. Returning Units for Repair or Recalibration

To return a unit for repair or recalibration please contact the Omega Engineering Customer Service Department. An Authorized Return (AR) number will then be issued. The AR number should then be noted on the outside of the package and on any correspondence. Further details may be found on page 28 of this manual.

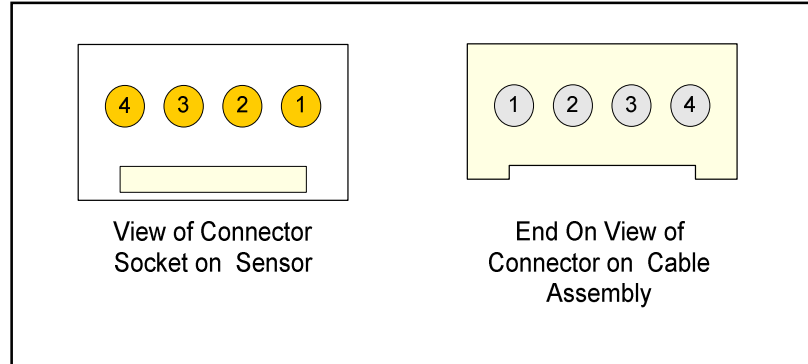
E. Specifications For Gas Units

	FLR1000	FLR1000-D	FLR1000-BR-D
Display	None	3.5 Digit LCD, 0.39" (10mm) high digits	
Accuracy (including linearity)	±3.0% Full Scale*		
Repeatability	±0.5% Full Scale*		
Pressure Rating	40 psig (2.8 bar)		
Temperature Rating	Operating Range: 5 to 55°C Storage Range: 0 to 70°C		
Temperature Sensitivity	±0.2% F.S.* or less per °C		
Wetted Materials	Ryton® 316 Stainless* Epoxy Glass Sapphire	Brass Ryton® 316 Stainless* Epoxy Glass Sapphire	
O-Ring Material	Standard - Viton® EPDM Optional		
Fitting Material (Standard)	Acetal	Brass	
Fitting Material Optional	Acetal, brass, or stainless steel		
Recommended Filtration	25 microns or less		
Compatible Gases	Clean, dry		
0-5VDC Output Signal	Standard Minimum 2.5 KΩ load		
Typical Power Consumption	Standard: 12 VDC @ 35 mA (11.5-15 VDC) Model 110 Power Adapter 115/230VAC		
Response Time	Typically <30 seconds for 67% of final value		
Reliability	100,000 hours MTBF		
Certifications	CE Approved 89/336/EEC (EN 55011 & EN 50082-1) 73/23/EEC Low Voltage Directive		
Ratings	IP10 (NEMA 1)		
Warranty	1 year limited		

*Specifications from 20-100% of rated flow. Linearity is best fit straight line. All calibrations performed with AIR unless otherwise stated on calibration certificate

F. Connector Pin And Wire Color Cross Reference

Pin Configuration for Connector Socket and Connector



Pin	Cable Wire Color	Description
1	Black	Signal & Power Negative (Ground)
2	White	Voltage Output
3	Red	Power Positive
4	Green	Not Used

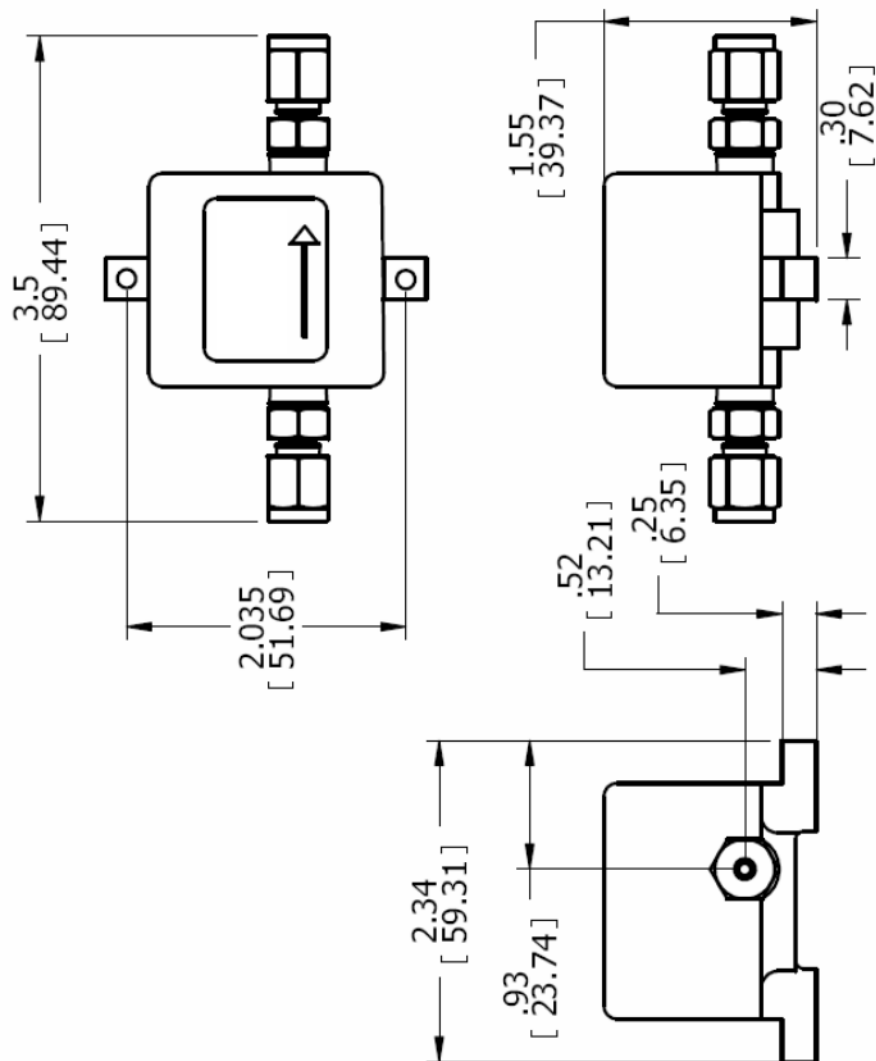
G. *Dimensions*

ALL DIMENSIONS IN INCHES (MILLIMETERS IN BRACKETS)

FLR 1000 For Gases

20-200 ml/min To 1.0-5.0 l/min Units

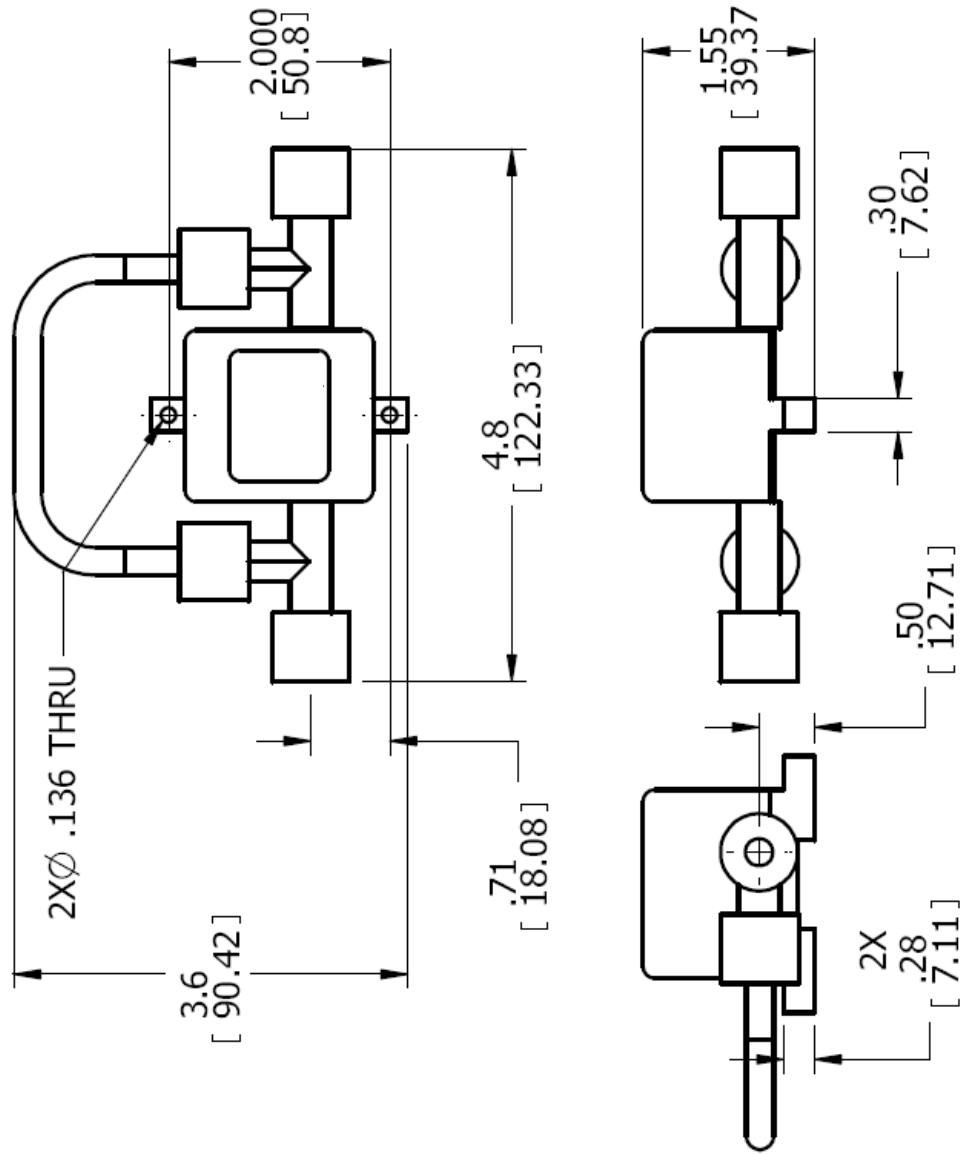
1/4" Acetal Fittings Shown



FLR 1000 For Gases

2.0-10.0 l/min Units

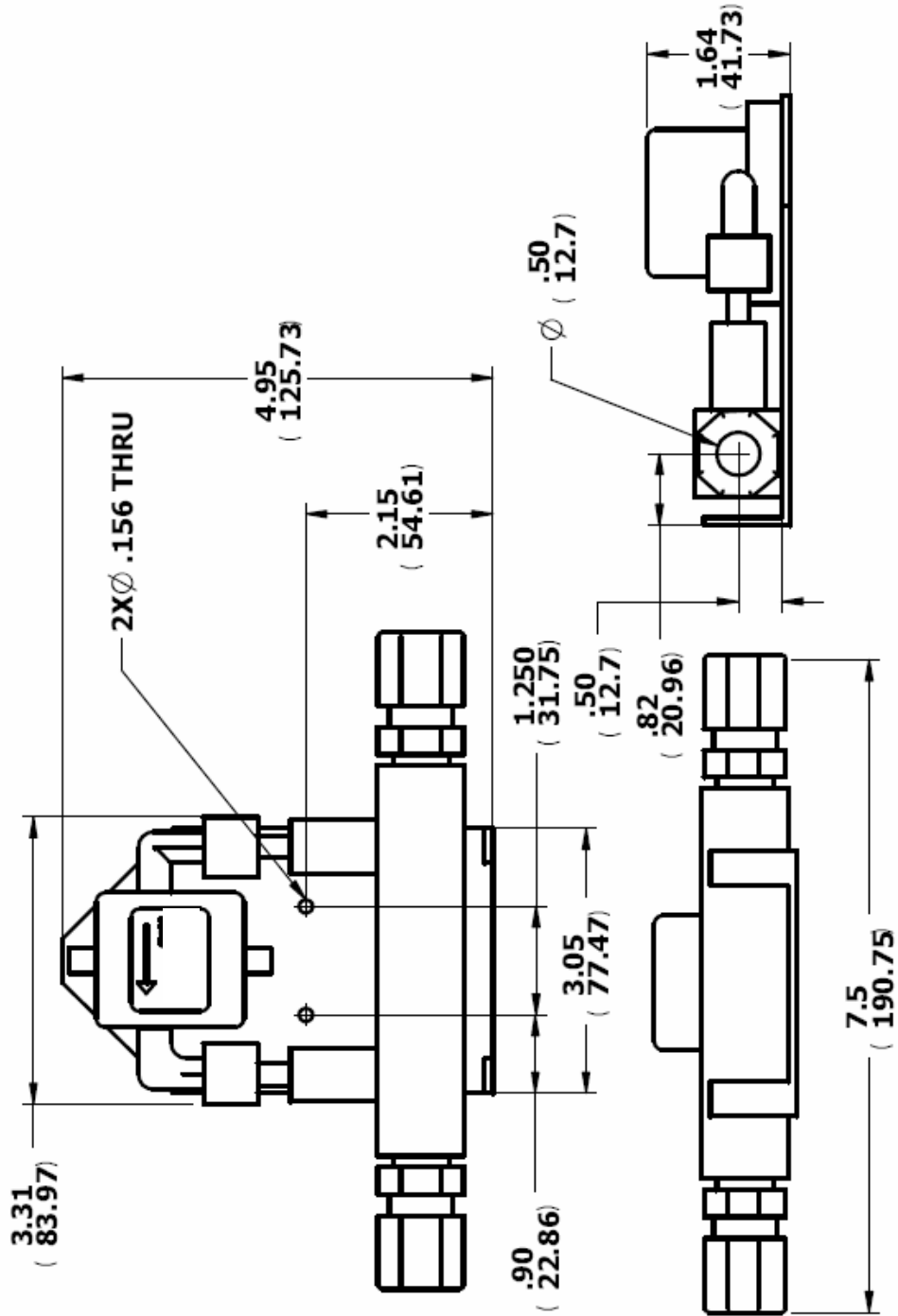
1/4" Acetal Fittings Shown



FLR 1000 For Gases

4.0-20.0 l/min To 100-500 l/min Units

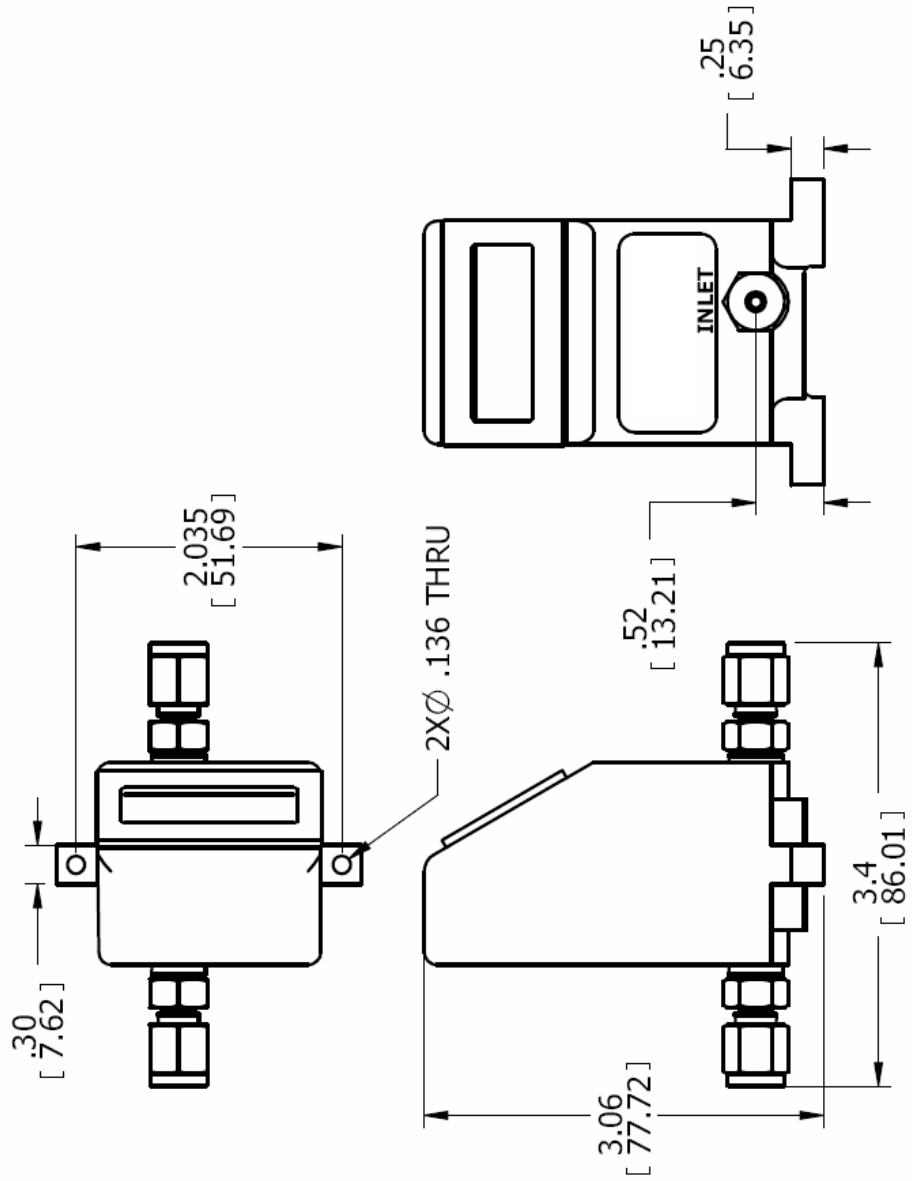
1/2" Acetal Fittings Shown



FLR 1000-D For Gases

20-200 ml/min To 1.0-5.0 l/min Units

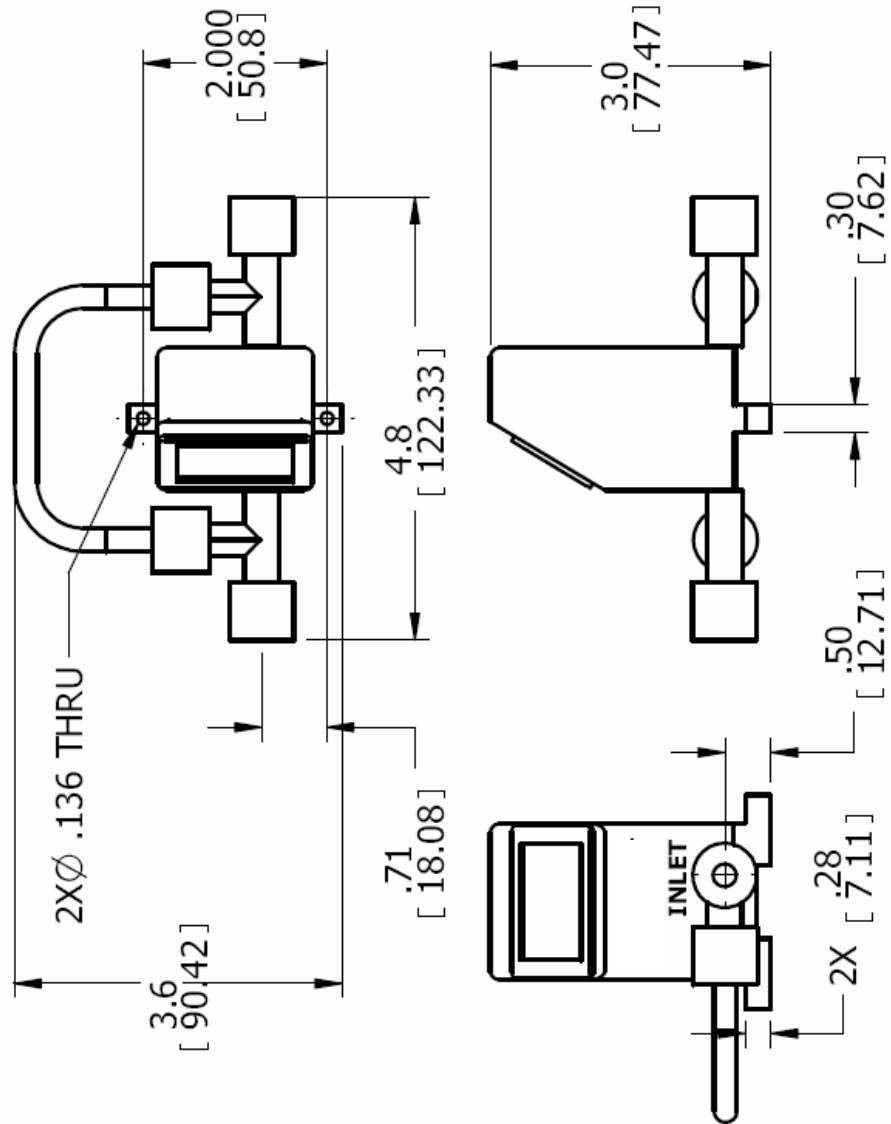
1/4" Acetal Fittings Shown



FLR 1000-D For Gases

2.0-10.0 l/min Units

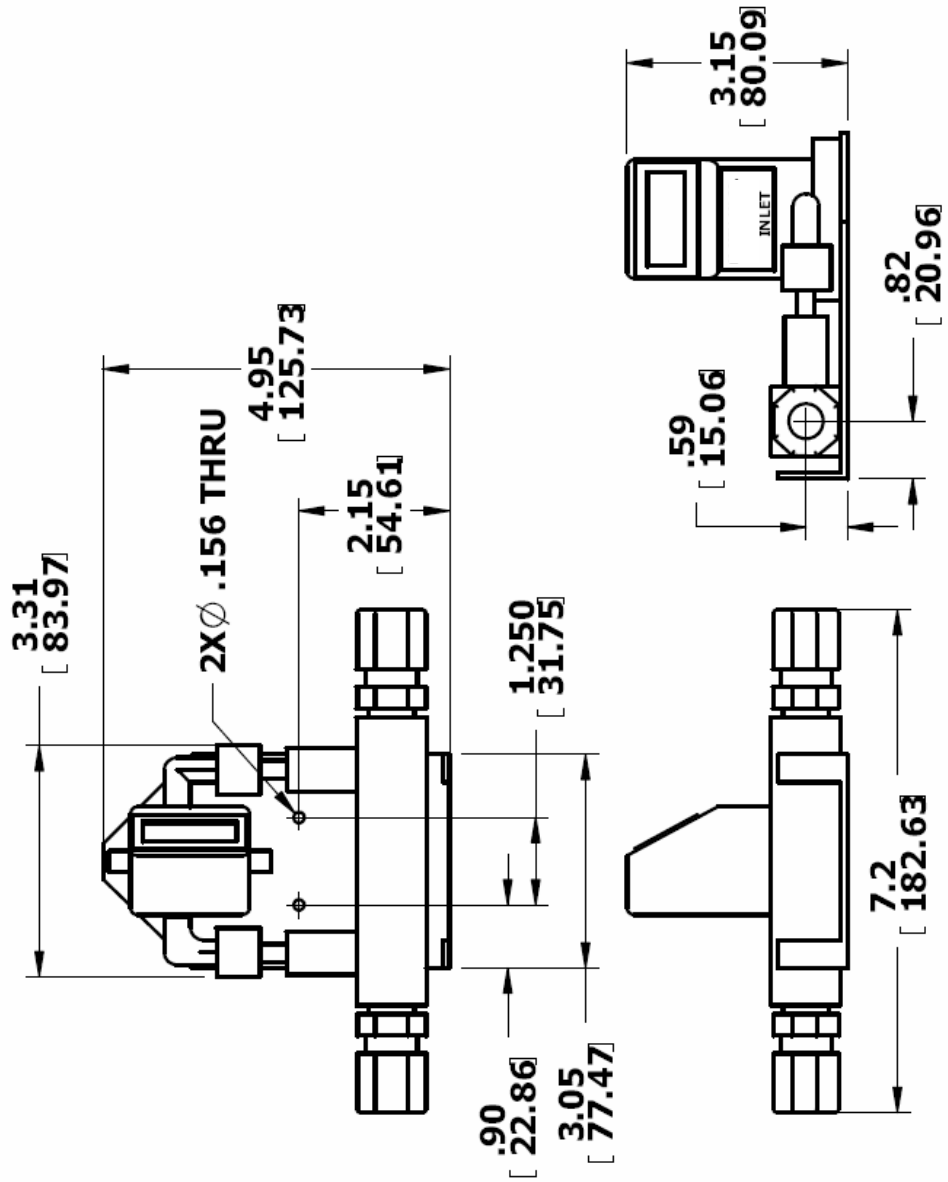
1/4" Acetal Fittings Shown



FLR 1000-D For Gases

4.0-20.0 l/min To 100-500 l/min Units

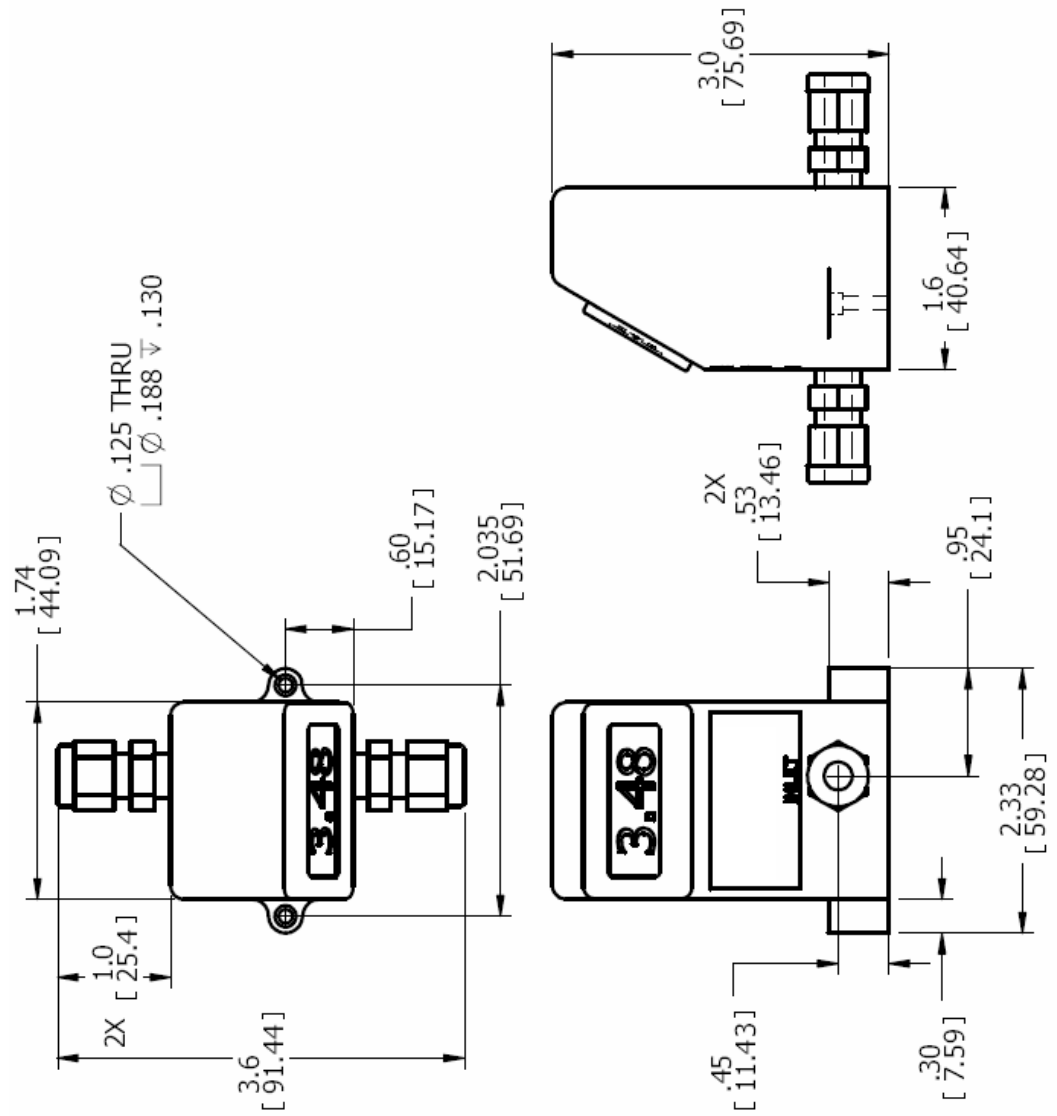
1/2" Acetal Fittings Shown



FLR 1000-BR-D For Gases

20-200 ml/min To 1.0-5.0 l/min Units

1/4" Brass Fittings Shown



H. *Troubleshooting Guide*

Symptom	Possible Cause	Method of Correction
Unit Leaks	Fittings not tight enough.	Tighten fittings (see section B4)
	Sensor assembly cracked	Unit must be returned for repair (see Section J)
No output signal or flow indication	No power or low power	Apply correct power
	No flow passing through unit	Display or output should read zero.
	Output shorted or overloaded	Check electrical connections (see section B5)
	Improper connection	Check electrical connections (see section B5) and ensure connector is correctly plugged in.
	Moisture on internal electronics	Allow unit to dry out in a dry environment.
	Output circuitry damaged	Unit must be returned for repair (see Section J)
Flow indication "bounces" or fluctuates	Flow is actually fluctuating	Correct flow source to obtain steady flow
	Using a pulsatile or piston pump that causes a pulsating flow of gas	Switch to a stable source of gas
	Not using the fittings supplied by the manufacturer	Use the supplied fittings
	Moisture in sensor	Remove moisture and allow unit to dry out
	Turbulence in tubing or sensor	Straighten the inlet tubing or lengthen it to at least 6" (150mm)
	Fluctuating input power	Correct the power source or change to a regulated supply
	Mechanical sensor assembly damaged	Unit must be returned for repair (see Section J)

Symptom	Possible Cause	Method of Correction
Flow indication is not linear and output too low at lower flows	<p>Attempting to measure flows below the specified minimum for the unit</p> <p>Moisture or liquid in sensor</p> <p>Mechanical sensor assembly damaged</p>	<p>Use higher flow rates</p> <p>Remove moisture and allow sensor to dry out</p> <p>Unit must be returned for repair (see Section J)</p>
Flow reading accuracy is outside the specification	<p>Gas has a specific gravity other than Air at 20°C</p> <p>Moisture in sensor</p> <p>Mechanical sensor assembly damaged</p> <p>Pressure drop issue</p>	<p>Calculate the flow reading error / offset as explained in section C6</p> <p>Allow sensor to dry out. Ensure gas is dry.</p> <p>Unit must be returned for repair (see Section J)</p> <p>Correct for the pressure drop (ΔP)</p>
Flow indication is fixed at one value	<p>The maximum rated flow for the unit is being exceeded.</p> <p>Output circuits may be damaged</p>	<p>Reduce the flow</p> <p>Unit must be returned for repair (see Section J)</p>

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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